

# **U.S. Hydropower Resource Assessment for Rhode Island**

**Prepared by:  
James E. Francfort**

**Project Manager:  
Ben N. Rinehart**

**Published July 1995**

**Idaho National Engineering Laboratory  
Renewable Energy Products Department  
Lockheed Idaho Technologies Company  
Idaho Falls, Idaho 83415**

**Prepared for the  
U.S. Department of Energy  
Assistant Secretary for Energy Efficiency and Renewable Energy  
Under DOE Idaho Operations Office  
Contract DE-AC07-94ID13223**

## **ABSTRACT**

The Department of Energy is developing an estimate of the undeveloped hydropower potential in the United States. The Hydropower Evaluation Software (HES) is a computer model that was developed by the Idaho National Engineering Laboratory for this purpose. The software measures the undeveloped hydropower resources available in the United States, using uniform criteria for measurement. The software was developed and tested using hydropower information and data provided by the Southwestern Power Administration. It is a menu-driven software program that allows the personal computer user to assign environmental attributes to potential hydropower sites, calculate development suitability factors for each site based on the environmental attributes present, and generate reports based on these suitability factors. This report details the resource assessment results for the State of Rhode Island.

## CONTENTS

ABSTRACT .....	iii
ACKNOWLEDGMENTS .....	vii
INTRODUCTION .....	1
Model Development .....	1
Model Goal .....	1
Dam Status .....	2
ASSESSMENT RESULTS .....	2
Summary Results .....	2
Detailed Results .....	2
OBTAINING INDIVIDUAL STATE INFORMATION .....	5
ADDITIONAL HYDROPOWER EVALUATION SOFTWARE INFORMATION .....	5
REFERENCES .....	7
Appendix A—Summary Report .....	A-1
Appendix B—River Basins Report .....	B-1
Appendix C—Rhode Island Sites List .....	C-1
Appendix D—Individual Resource Database List .....	D-1

## FIGURES

1. Number of sites with HES-modeled undeveloped hydropower potential .....	3
2. The HES-modeled undeveloped hydropower potential and the non-modeled undeveloped hydropower potential .....	3
3. The number of sites with undeveloped hydropower potential and the total megawatts of HES-modeled undeveloped hydropower potential .....	4

## TABLES

1. Summary of undeveloped hydropower potential for Rhode Island .....	2
---	---

## **ACKNOWLEDGMENTS**

The author thanks Peggy A. M. Brookshier, John V. Flynn and S. J. Seymour of the Department of Energy and James Sheusi of the State of Rhode Island and Providence Plantations for their active participation and timely comments.

# U.S. Hydropower Resource Assessment for Rhode Island

## INTRODUCTION

In June 1989, the U.S. Department of Energy initiated the development of a National Energy Strategy to identify the energy resources available to support the expanding demand for energy in the United States. Public hearings conducted as part of the strategy development process indicated that undeveloped hydropower resources were not well defined. As a result, the Department of Energy established an interagency Hydropower Resource Assessment Team to ascertain the undeveloped hydropower potential. In connection with these efforts by the Department of Energy, the Idaho National Engineering Laboratory designed the Hydropower Evaluation Software (HES), which has been used to perform a resource assessment of the undeveloped conventional hydropower potential in Rhode Island (as well as several other states). This report presents the results of the hydropower resource assessment for the State of Rhode Island. Undeveloped pumped storage hydropower potential is not included.

The HES was developed as a tool to measure undeveloped hydropower potential regionally or by state. The software is not intended to provide precise development factors for individual sites, but to provide regional or state totals. Because the software was developed as a generic measurement tool encompassing national issues, regional and state totals must be considered judiciously; various local issues may skew undeveloped hydropower potential totals. The information for the resource assessment was compiled from the Federal Energy Regulatory Commission's Hydroelectric Power Resources Assessment database and several other sources. Refer to DOE/ID-10338, the *User's Manual* (Francfort, Matthews, Rinehart 1991) for the specifics of the software and to DOE/ID-10430, the *Status Report*

(Francfort, Moore, Rinehart 1993) for an overview of all resource assessment activities to date.

## Model Development

Hydropower Evaluation Software, both a probability-factor computer model and a database, is a menu-driven software program that is intended to be user-friendly. Computer screens and report generation capabilities were developed to meet the needs of users nationwide. The software uses environmental attribute data to generate an overall Project Environmental Suitability Factor (PESF) between 0.1 and 0.9, where 0.9 indicates the highest likelihood of development and 0.1 indicates the lowest likelihood of development. The suitability factors depend on the unique environmental attributes of each potential site. They reflect the considerations that (a) environmental concerns can make a potential site unacceptable, prohibiting its development (for a suitability factor of 0.1), or (b) if there are no environmental concerns, there is no effect on the likelihood of site development (for a suitability factor of 0.9). A combination of attributes can result in a lower suitability factor because multiple environmental considerations would reduce the likelihood that a site may be developed to its physical potential.

## Model Goal

The goal of the HES is to assemble an accurate resource database of all sites with undeveloped hydropower potential in the United States for use as a planning tool to determine the viable national hydropower potential. Undeveloped hydropower potential is not limited to the development of new sites; it also includes the development of additional hydropower generating capacity at sites that currently have hydropower but are not developed to their full potential. This undeveloped hydropower potential is a source of nonpolluting, renewable energy available to meet the growing

power needs of the United States. The HES should help make this goal obtainable and ensure a set of uniform criteria for national assessment.

## Dam Status

The effects of environmental attributes vary by dam status. The dam status classifications used are as follows:

W = Developed hydropower site with current power generation, but the total hydropower potential has not been fully developed. Only the undeveloped hydropower potential is discussed in this report.

W/O = Developed site without current power generation. The site has some type of developed impoundment or diversion structure, but no developed hydropower generating capability.

U = Undeveloped site. The site does not have power generation capability nor a developed impoundment or diversion structure.

## ASSESSMENT RESULTS

### Summary Results

A total of 30 sites (Table 1) have been identified and assessed for their undeveloped hydropower potential. The HES results for individual site capacities range from 24 kilowatts to 1.35 megawatts. Most of the sites have potential capacities of under 1 megawatt (Figure 1).

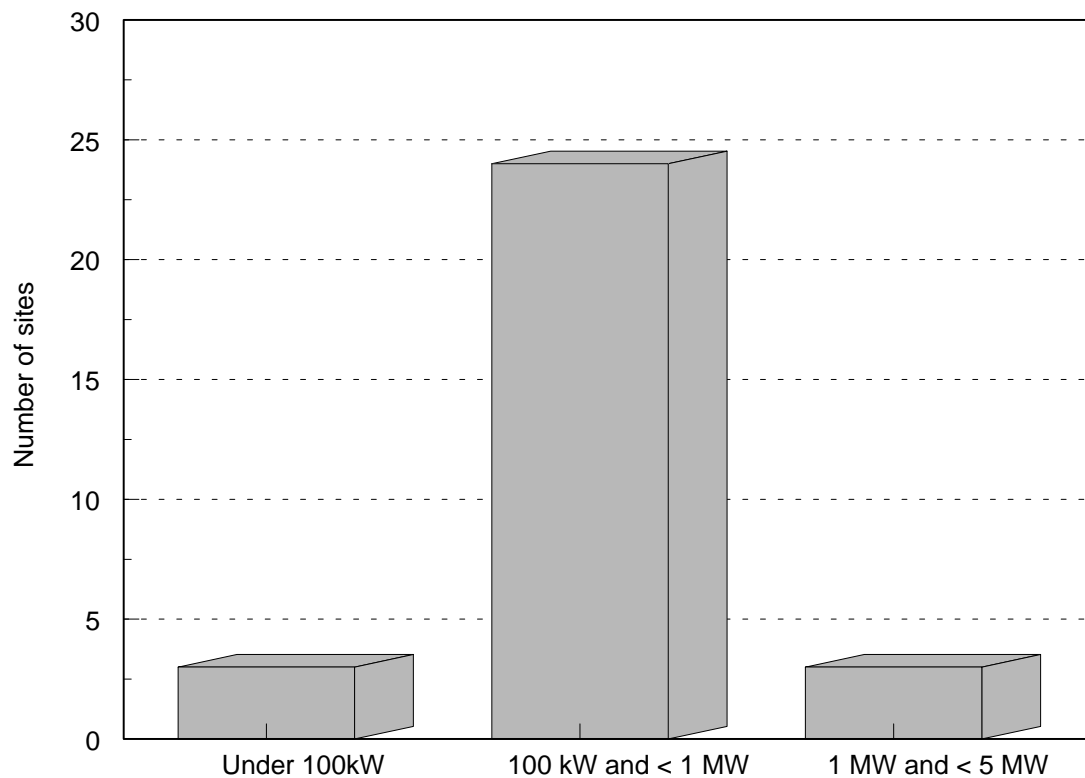
The non-modeled undeveloped hydropower potential total for Rhode Island was identified as 13.5 megawatts. The HES results lower this estimate about 15% to 11.5 megawatts. About equal reductions in undeveloped hydropower potential (15%) occur at sites that are undeveloped and at those sites that have physical structures but no current generation capability (Figure 2). There are no sites that currently generate power and have additional undeveloped potential. At those sites modeled by the HES, the number of sites does not change, only the identified undeveloped hydropower potential is assessed (Figure 3). The 30 identified sites with undeveloped hydropower potential in Rhode Island are all located within minor river basins.

### Detailed Results

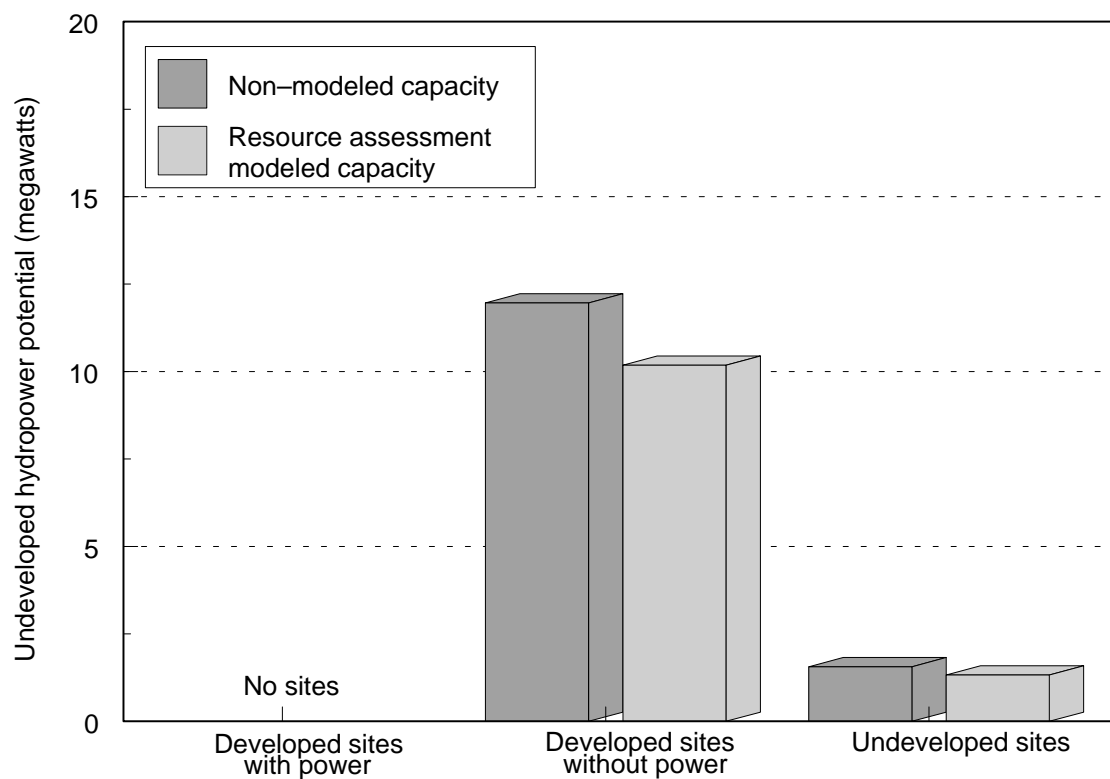
The appendices contain, in the form of HES-generated reports, detailed information about the undeveloped hydropower potential in Rhode Island. The appendices contain the following:

**Table 1.** Undeveloped hydropower potential summaries for Rhode Island. The table contains the non-modeled undeveloped name plate potential, as well as the HES-modeled undeveloped hydropower potential totals.

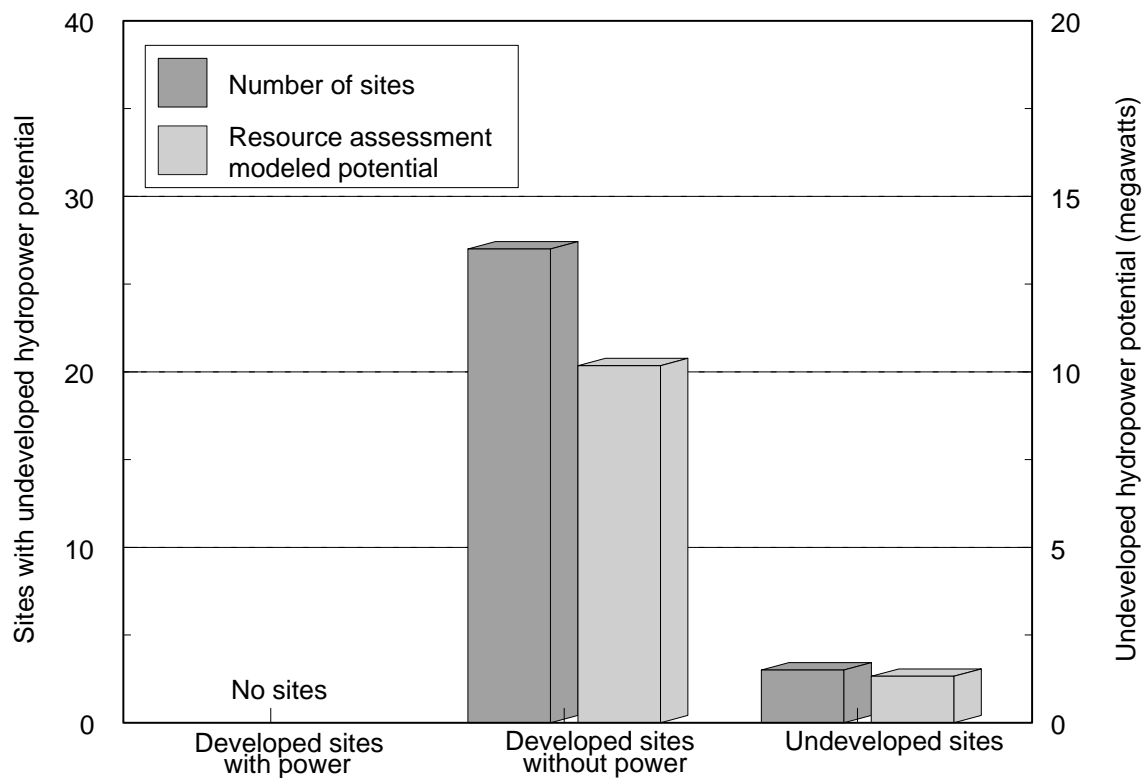
	Number of projects	Name plate potential (MW)	HES modeled potential (MW)
With Power	0	0	0
W/O Power	27	12.0	10.2
Undeveloped	3	1.6	1.3
State Total	30	13.5	11.5



**Figure 1.** Number of sites with HES-modeled undeveloped hydropower potential.



**Figure 2.** The HES-modeled undeveloped hydropower potential and the non-modeled undeveloped hydropower potential.



**Figure 3.** The number of sites with undeveloped hydropower potential and the total megawatts of HES-modeled undeveloped hydropower potential.

Appendix A The undeveloped hydropower potential summary groups sites by dam status. The number of sites, non-modeled undeveloped hydropower potential, and HES-modeled undeveloped hydropower potential are provided based on the dam status.

a site is Federally owned, non-modeled undeveloped hydropower potential, and HES-modeled undeveloped hydropower potential. The sites are grouped by dam status.

Appendix B The hydropower resource assessment by river basin includes the project number, project name, stream name, dam status, non-modeled undeveloped hydropower potential, and the HES-modeled undeveloped hydropower potential for each site. Subtotals are provided for each river basin.

#### Appendix D

This section contains a resource database list for each of the 30 sites in Rhode Island. Information includes plant name, stream, state, county, river basin and owner names, project number, name plate and HES-modeled undeveloped hydropower potential, the unit and plant types, dam status, latitude, longitude, and the environmental factors that the HES uses to determine the project environmental suitability factor.

Appendix C This is a list of the project numbers, plant name, stream name, if



## OBTAINING INDIVIDUAL STATE INFORMATION

Additional copies of the hydropower resource assessment results for individual states are available and can be obtained by writing or calling the National Technical Information Service (NTIS).

**Telephone Orders**—(703) 487-4650. NTIS sales desk and customer services are available between 8:30 a.m. and 5:00 p.m., Eastern Standard Time.

**Fax**—(703) 321-8547. Customers may fax their orders to NTIS. These orders may be charged to a NTIS deposit account, American Express, VISA, or MasterCard.

**Mail Orders**—Mail orders should be sent to National Technical Information Service, Document Sales, 5285 Port Royal Road, Springfield, VA 22161. Call the sales desk for prices before placing an order.

**Method of Payment**—Customers may pay for reports (and other NTIS products and services) by (a) credit card (American Express, Visa or MasterCard); (b) check or money order on a United States bank payable to NTIS; (c) a NTIS deposit account; or, (d) by asking to be billed (add \$7.50 per order), United States, Canada, and Mexico, only.

**Handling Fee**—A \$3.00 handling fee per total order applies to orders from the United States, Canada, and Mexico. Handling charges do not apply to rush order service or pick-up orders.

**Postage and Shipping**—Orders are shipped first class mail, or equivalent, to addresses in the United States, Canada, and Mexico.

**Order Turnaround Time**—Orders for technical reports generally are shipped within 2 to 8 days of receipt. For faster service, NTIS offers rush order service.

**Rush Order Service**—Call 1-800-533-NTIS. In Virginia, Canada, and Mexico call (703) 487-4700. For NTIS rush order service add \$15.00 per item. This guarantees that an order will be processed through NTIS within 24 hours of its receipt. These orders receive immediate, individual attention. The items ordered are delivered by first call mail. Call NTIS for information on rush order service for computer products.

**For Help in Tracing an Order**—Call (703) 487-4650 and request the customer service option.

## ADDITIONAL HYDROPOWER EVALUATION SOFTWARE INFORMATION

Additional information concerning the HES can be obtained by contacting Ben Rinehart or Jim Francfort at the addresses provided below. Copies of the software and the User's Manual may also be obtained from these individuals.

Ben Rinehart  
Idaho National Engineering Laboratory  
P.O. Box 1625, M.S. 3830  
Idaho Falls, ID 83415-3830  
(208) 526-1002

Jim Francfort  
Idaho National Engineering Laboratory  
P.O. Box 1625, M.S. 3875  
Idaho Falls, ID 83415-3875  
(208) 526-6787

Information concerning the State of Rhode Island's involvement with the resource assessment or about the identified sites may be obtained by contacting:

James Sheusi  
State of Rhode Island and Providence Plantations  
Governor's Office of Housing, Energy, & Intergovernmental Relations  
275 Westminster St.  
Providence, RI 02903  
(401) 277-3370

## REFERENCES

- Francfort, J. E., S. D. Matthews, and B. N. Rinehart, 1991, *Hydropower Evaluation Software User's Manual*, DOE/ID-10338, Idaho National Engineering Laboratory, Idaho Falls, Idaho.
- Francfort, J. E., K. M. Moore, and B. N. Rinehart, 1993, *Uniform Criteria for U.S. Hydropower Resource Assessment, Hydropower Evaluation Software Status Report*, DOE/ID-10430, Idaho National Engineering Laboratory, Idaho Falls, Idaho.